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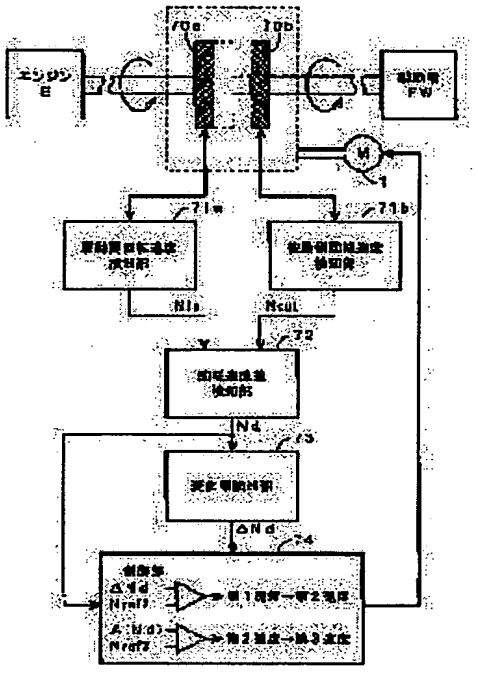
(54) CLUTCH CONNECTION CONTROL DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a clutch connection control device capable of shortening a time for connection of a clutch, preventing riding comfortableness from becoming rough at the time of connection, and providing a good operability.
SOLUTION: A distance between a driving side 70a and a driven side 70b of a clutch, namely lift amount is controlled by a clutch release mechanism 70 driven by an electric motor 1. A driving side rotating speed detecting unit 71a detects rotating speed Nin of the driving side 70a. A driven side rotating speed detecting unit 71b detects rotating speed Nout of the driven side 70b. A rotating speed difference detecting unit 72 detects a difference Nd between each of rotating speeds Nin and Nout. A change rate detecting unit 73 detects a time change rate ΔNd of the rotating speed difference Nd. In a control unit 74, the clutch is connected at second speed until an absolute value A(Nd) of the rotating speed difference attains a prescribed value and less. After that, the clutch is connected at third speed faster than the first speed.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] A clutch release means to rotate an electric motor and to make a driving-side [of a clutch], and passive-movement side ****, A driving-side rotational-speed detection means to detect the rotational speed of the driving side of said clutch, A passive-movement side rotational-speed detection means to detect the rotational speed by the side of passive movement of said clutch, A rotational-speed difference detection means to detect the difference of said detected driving-side rotational speed and passive-movement side rotational speed, In the clutch connection control unit which possesses the control means which controls **** of the clutch by the clutch release means based on said detected rotational-speed difference A comparison means [a predetermined value / difference / said / rotational-speed] is provided further. Said control means It is the clutch connection control unit characterized by connecting at the 2nd rate quicker than said 1st rate after connecting said clutch at the 1st rate and becoming said below predetermined value until said rotational-speed difference became below the predetermined value.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the clutch connection control device of the electromotive change gear which performs intermittence of gear-shifting and a clutch by the electric motor, and relates to the clutch connection control device which carries out adjustable control of the connection rate of a clutch especially based on the driving side of a clutch, and the rotational speed by the side of passive movement.
[0002]
[Description of the Prior Art] The electromotive change gear which performs gear-shifting electrically by the motor is proposed in JP,1-122741,A to the conventional change gear which operates the both sides of clutch pedal (or clutch lever) and a shift change lever, and performs gear-shifting.
[0003] Moreover, in order to shorten the time amount which clutch connection takes and to raise a degree of comfort at the time of clutch connection, as shown in drawing 33 , the working speed of a clutch canceling release mechanical system, i.e., the rotational speed of a drive motor, is controlled by the above-mentioned conventional technique so that the driving side of a clutch and the rotational-speed difference by the side of passive movement follow the time function of a schedule.
[0004] Furthermore, in the advanced technology (JP,11-82709,A) by these people, the timing of the schedule predicted to be the node of a clutch carries out high-speed operation of the clutch canceling release mechanical system at the time of clutch connection, and is made to carry out low-speed actuation after schedule timing.
[0005] Since according to such a configuration a clutch is moved at high speed in the operating space where a clutch does not contact and it is moved with a low speed in the operating space where a clutch is connected, gear change time amount is shortened and a degree of comfort at the time of gear change improves.
[0006]
[Problem(s) to be Solved by the Invention] With the 1st above-mentioned conventional technique (JP,1-122741,A), if the engine-speed difference a driving side and by the side of passive movement becomes zero, it will be judged as what the half-clutch condition ended and connection actuation of a clutch ended. However, even if the engine-speed difference a driving side and by the side of passive movement becomes zero, actuation of the drive system for making a clutch drive is not yet completed, but actuation for returning each part of a drive system to an initial location is performed succeedingly.
[0007] However, with the above-mentioned conventional technique, after the rotational frequency difference a driving side and by the side of passive movement became zero, about time amount compaction until it returns each part to an initial location and makes automatic gear change actuation complete, it is not taken into consideration at all.
[0008] With the 2nd above-mentioned conventional technique (JP,11-82709,A), to the connection start point (start point of a half-clutch) of a clutch, although connection actuation is performed at high speed, the connection actuation with a low speed is succeedingly continued

until each part of a clutch drive system returns to an initial location, even if a half-clutch condition converges after connection initiation of a clutch (after initiation of a half-clutch) and connection is completed. Therefore, delicate gap will arise to the termination timing of the clutch connection which an operator feels, and the termination timing of the clutch connection by the automatic transmission.

[0009] For this reason, even if an operator performs the next gear change actuation immediately after ending the first gear change actuation, sense of incongruity may be given to an operator, without the ability of an automatic transmission answering correctly.

[0010] The purpose of this invention solves the above-mentioned Prior-art technical problem, can shorten the time amount which automatic gear change takes, and is to offer the clutch connection control unit with which a degree of comfort does not become coarse at the time of connection of a clutch, either, and good operability is acquired.

[0011]

[Means for Solving the Problem] A clutch release means for this invention to rotate an electric motor and to make a driving-side [of a clutch], and passive-movement side **** in order to attain the above-mentioned purpose, A driving-side rotational-speed detection means to detect the rotational speed of the driving side of said clutch, A passive-movement side rotational-speed detection means to detect the rotational speed by the side of passive movement of said clutch, A rotational-speed difference detection means to detect the difference of said detected driving-side rotational speed and passive-movement side rotational speed, In the clutch connection control unit which possesses the control means which controls **** of the clutch by the clutch release means based on said detected rotational-speed difference After it provided further the comparison means [a predetermined value / difference / said / rotational-speed], and said control means connected said clutch at the 1st rate and became said below predetermined value until said rotational-speed difference became below the predetermined value, it is characterized by connecting at the 2nd rate quicker than said 1st rate.

[0012] According to the above-mentioned description, since connection actuation is performed with a low speed, the connection start point (start point of a half-clutch) of a clutch which influences the right and wrong of a degree of comfort to the point (ending point of a half-clutch) ending [connection] can maintain a good degree of comfort, and connection actuation is further performed at high speed to termination of automatic gear change actuation from the point of a clutch of not influencing the right and wrong of a degree of comfort ending [connection]. Therefore, the time amount which automatic gear change takes can be shortened, a degree of comfort does not become coarse at the time of connection of a clutch, either, and good operability is acquired.

[0013]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail with reference to a drawing. Drawing 1 is the top view of the control unit of the car equipped with the electromotive change gear containing the clutch connection control unit of this invention.

[0014] The shift up switch 51 for electric gear change and the down-shift switch 52, the dimmer switch 53 that switches the sense of a headlight up and down, the head lamp switch 54 which switches lighting / astigmatism LGT of a headlight, and the engine start switch 55 and the engine stop switch 56 are formed in the control unit. With this operation gestalt, whenever it pushes said each shift switches 51 and 52 and carries out ON actuation, a shift position shifts one step at a time up and down, respectively.

[0015] Drawing 2 is the fragmentary sectional view having shown the configuration of the principal part of the drive system of the electromotive change gear with which this invention is applied.

[0016] The drive motor 1 as an electric actuator rotates the shift spindle 3 in the forward inversion direction through the moderation gear device 2. The rotation location (include angle) of the shift spindle 3 is detected by the angle-type sensor 28 formed in the end. The translator 8 which changes rotation of the shift spindle 3 into the end of the clutch arm 6 extended perpendicularly from the shift spindle 3 at the translatory movement is formed. If the shift spindle 3 rotates from a neutral location with a drive motor 1, regardless of the rotation

direction, a translator 8 will cancel connection of the gear change clutch 5 in a rotation process, and will return it to a connection condition in the process again rotated to the reverse sense to a neutral location. When the shift spindle 3 rotates to a schedule include angle (for example, **6 times), the clutch arm 6 and the translator 8 are constituted so that connection of the gear change clutch 5 may be canceled.

[0017] The end of the master arm 7 fixed to the shift spindle 3 will rotate the shift drum 10 in the direction according to the rotation direction, if it engages with the clutch device 9 prepared in the shift drum shaft 8 and the shift spindle 3 rotates with a drive motor 1. When it engages with the shift spindle 3 and the shift drum 10 is rotated, when the shift spindle 3 rotates in the direction of either from a neutral location, and it rotates in the direction which returns to a neutral location, the master arm 7 and the clutch device 9 cancel an engagement condition, and limit the shift drum 10 to the location concerned.

[0018] If it engages with the periphery slot 31 of each sleeve 30 later mentioned about drawing 4 and the parallel displacement of each shift fork 11 is carried out to shaft orientations according to rotation of the shift drum 10, according to the hand of cut and angle of rotation of the shift drum 10, one of sleeves will carry out the parallel displacement of the tip of each shift fork 11 on the Maine shaft 4.

[0019] Drawing 4 is the perspective view of said sleeve 30, and is ****(ed) to the Maine shaft (illustration abbreviation) in the condition which can slide on shaft orientations. The slot 31 where the tip of said shift fork is engaged is formed in the periphery side face of a sleeve 30 along with the circumferencial direction. Two or more convex side dowels 32 which engage with the concave side dowel 42 of the gear 40 later mentioned about drawing 5 are formed in the periphery section of the axial hole of a sleeve 30 in one with the annular flange 33.

[0020] Drawing 5 is the perspective view of said gear 40, and is supported to revolve free [rotation] by the predetermined location on the Maine shaft (illustration abbreviation). Two or more concave side dowels 42 which engage with the convex side dowel 32 of said sleeve 30 are formed in the periphery section of the axial hole of a gear 40 in one with the annular flange 43. Drawing 3 is the conceptual diagram having shown the condition that said sleeve 30 and gear 40 were mutually engaged with each dowels 32 and 42.

[0021] On the other hand, drawing 9 and 10 are the conventional sleeve 38 and the perspective view of a gear 48, respectively, and two or more convex side dowels 39 are formed independently the shape of an axial hole and the same axle of a gear with the sleeve 38, respectively. However, if it is going to constitute each convex side dowel 39 in independent, in order to secure sufficient reinforcement, the area of base of each convex side dowel 39 must be enlarged comparatively. For this reason, with the conventional technique, the rate that the width of face about the hand of cut of the nib 49 of the convex side dowel 39 and a gear 40 occupies became large, and the convex side dowel 39 provided about four, as illustrated.

[0022] Drawing 12 was drawing which expressed typically the relative physical relationship of the convex side dowel 39 of the conventional sleeve 38, and the nib 49 of a gear 48, and the width of face D2 of the hand of cut of a nib 49 was about about 2 times of the width of face D1 of the convex side dowel 39. For this reason, the period Ta when the convex side dowel 39 cannot be engaged in a nib 49 (dowel in) was long compared with the period Tb which can carry out dowel in.

[0023] On the other hand, since each convex side dowel 32 is formed in one of the annular flange 33 with this operation gestalt, the width of face D3 of the hand of cut of the convex side dowel 32 and width of face D4 of the concave side dowel 42 of a gear 40 can be shortened enough, maintaining sufficient reinforcement, as shown in drawing 13 . For this reason, it becomes possible to raise the probability which can shorten the period Ta which cannot carry out the dowel in of the convex side dowel 32 to a nib 46 compared with the period Tb which can carry out dowel in, and can carry out the dowel in of it.

[0024] Moreover, with this operation gestalt, since the difference of the width of face D5 of the hand of cut of a nib 46 and the width of face D3 of the convex side dowel 32 can be narrowed, play after both engagement can be made small and reduction of a gear change noise is attained.

[0025] Furthermore, since the taper of the concave side dowel 42 was made into the shape of a

straight line as shown in drawing 7 while incurvating the taper of the convex side dowel 32 to convex as shown in drawing 6 , shaft orientations can be made to carry out line contact of each dowels 32 and 42 with this operation gestalt, as shown in drawing 8 . For this reason, while being able to prevent concentration of stress and raising dowel reinforcement substantially, endurance and wear-resistant improvement are attained.

[0026] In such a configuration, if parallel translation of said sleeve 30 is carried out to a predetermined position by the shift fork 11 and the convex side dowel 32 of a sleeve 30 carries out dowel in to the nib 46 of a gear 40, by the sleeve, the gear currently supported in the state of the slip to the Maine shaft 4 will engage with the Maine shaft 4 concerned, and will carry out synchronous rotation so that it may be known well. Consequently, the turning effort transmitted to countershaft (not shown [both]) is transmitted to the Maine shaft 4 through the gear concerned from a clutch shaft.

[0027] In addition, although illustration is omitted, the engine of the car concerned is a four cycle and engine power is transmitted to the power transfer system from a crankshaft to a main shaft through the centrifugal clutch on a crankshaft, and the clutch on a main shaft. Therefore, when an engine speed is below a predetermined value, the centrifugal clutch has cut power transfer at the clutch on a main shaft. Therefore, if it is [car] under halt, it will become possible to shift a gear also to ****.

[0028] Drawing 14 is the block diagram having shown the configuration of the principal part of the control system of an electromotive change gear, and drawing 15 is the block diagram having shown the example of a configuration of ECU100 shown in drawing 14 .

[0029] Ne which said drive motor 1 is connected to the MOTOR (+) terminal of ECU100, and a MOTOR (-) terminal in drawing 14 , and detects the speed sensor 26 which detects the vehicle speed for the sensor signal terminals S1, S2, and S3, respectively, and an engine speed Said angle-type sensor 28 which detects angle of rotation of a sensor 27 and said shift spindle 3 is connected. Said shift up switch 51 and the down-shift switch 52 are connected to the gear change command terminals G1 and G2.

[0030] The dc-battery 21 is connected also to VB terminal through the fail-safe (F/S) relay 25 and the fuse box 24 while connecting with the MAIN terminal of ECU100 through the Maine fuse 22, a main switch 23, and a fuse box 24. Exiting coil 25a of the fail-safe (F/S) relay 25 is connected to the RELAY terminal.

[0031] Within ECU100, as shown in drawing 15 , said MAIN terminal and a RELAY terminal are connected to a power circuit 106, and the power circuit 106 is connected to CPU101. Said sensor signal terminals S1, S2, and S3 are connected to the input terminal of CPU101 through the interface circuitry 102. Said gear change command terminals G1 and G2 are connected to the input terminal of CPU101 through the interface circuitry 103.

[0032] A switching circuit 105 carries out parallel connection of FET** and FET** by which series connection was carried out, respectively and FET**, and the FET** mutually, and is constituted, the end of parallel connection is connected to said VB terminal, and the other end is connected to the GND terminal. The node of FET** and FET** is connected to a MOTOR (-) terminal, and the node of FET** and FET** is connected to the MOTOR (+) terminal. PWM control of each FET** - the FET** is alternatively carried out by CPU101 through PURIDORAIBA 104. CPU101 controls each FET** - FET** based on the control algorithm memorized by memory 107.

[0033] Subsequently, the gear change approach in this operation gestalt is explained with reference to the flow chart of drawing 16 -19, and the timing chart of drawing 32 of operation.

[0034] At step S10, if judged with ON actuation of whether ON actuation of one of the shift switches was carried out having been judged and carried out, in step S11, it will be judged any of the shift up switch 51 and the down-shift switch 52 the shift switches by which ON actuation was carried out are. If judged with having progressed to step S13 when judged with ON actuation of the shift up switch 51 having been carried out here, and ON actuation of the down-shift switch 52 having been carried out, it sets to step S12 and is an engine speed Ne. It progresses to step S13, after memorizing as a variable Ne1.

[0035] each FET which constitutes said switching circuit 105 in ECU100 from a step S13

according to the shift switch by which ON actuation was carried out -- time of day t1 of drawing 32 from -- PWM control is carried out alternatively. That is, if ON actuation of the shift up switch 51 is carried out, PWM control of FET** and the ** will be carried out by 100% of duty ratio, with FET** and ** intercepted. Consequently, a drive motor 1 starts the rotation to the direction of a shift up, this is interlocked with and the shift spindle 3 also starts the rotation to the direction of a shift up.

[0036] On the other hand, if ON actuation of the down-shift switch 52 is carried out, PWM control of FET** and the ** will be carried out by 100% of duty ratio, with FET** and ** intercepted. Consequently, a drive motor 1 starts rotation in the direction of a down shift of the reverse sense, is interlocked with said direction of a shift up at this, and the shift spindle 3 also starts the rotation to the direction of a down shift.

[0037] Thus, if duty ratio is set up to 100%, shift speed can be made quick and a clutch can be separated quickly. In addition, with this operation gestalt, if a shift spindle rotates only 5 to 6 times, it is designed so that a clutch may go out.

[0038] At step S14, the 1st timer (not shown) starts a time check, and it is the rotation include angle theta 0 of said shift spindle 3 at step S15. It is detected by said angle-type sensor 28. Rotation include angle theta 0 detected at step S16 1st criteria include-angle thetaREF (this operation gestalt **14 degrees) It is judged whether it is having exceeded (more than +14 degree or -14 degrees or less; it expresses more than as only whenever [**xx] henceforth).

[0039] Here, it is the rotation include angle theta 0. If judged with **14 degrees or more, since possibility that the sleeve by which parallel translation was carried out with the shift fork 11 has reached to the fit-in (dowel in) location of normal is high, it will progress to step S17, but if it does not amount to **14 degrees or more, since it can judge that the sleeve has not reached to the fit-in location of normal, it progresses to step S30 mentioned later.

[0040] The parallel displacement of the sleeve is carried out to the fit-in location of normal, and things are time of day t2. It sets and is said rotation include angle theta 0. It is based, and if detected, said 1st timer will be reset at step S17. At step S18, in order to apply braking to the drive motor 1 under rotation, according to the shift switch by which ON actuation was carried out, PWM control of each FET of said switching circuit 105 is carried out alternatively.

[0041] That is, if it is among a shift up, PWM control of FET** and the ** will be carried out by 100% of duty ratio, with FET** and ** intercepting. On the other hand, if it is among a down shift, PWM control of FET** and the ** will be carried out by 100% of duty ratio, with FET** and ** intercepting. Consequently, since a drive motor 1 short-circuits and it becomes a rotation load, a braking operation can work to the driving torque to the direction of a shift up or the direction of a down shift of the shift spindle 3, the impact at the time of the shift spindle 3 contacting a stopper can be weakened, and it becomes in reinforcement, in noise, and advantageous. In addition, angle of rotation of the shift spindle 3 at the time of contacting a stopper is 18 degrees.

[0042] the 2nd timer for step S19 of drawing 17 to prescribe braking time -- a time check -- starting -- step S20 -- the time check of the 2nd timer -- it is judged whether time amount exceeded 15ms. the time check of the 2nd timer -- it progresses to step S21 until time amount exceeds for 15ms, and engine-speed (Ne) control explained in full detail behind is performed. then, time of day t3 setting -- a time check -- if time amount exceeds 15ms, it will progress to step S22 and the 2nd timer will be reset.

[0043] At step S23, PWM control of each FET of said switching circuit 105 is alternatively carried out according to the shift switch by which ON actuation was carried out. That is, if it is among a shift up, PWM control of FET** and the ** will be carried out by 70% of duty ratio, with FET** and ** intercepted. On the other hand, if it is among a down shift, PWM control of FET** and the ** will be carried out by 70% of duty ratio, with FET** and ** intercepted. Consequently, since a sleeve is forced on a gear side with comparatively weak torque, in the load which joins each dowel being mitigated by even dowel in, a dowel in condition can be certainly held now.

[0044] step S24 -- the 3rd timer -- a time check -- starting -- step S25 -- the time check of the 3rd timer -- it is judged whether time amount exceeded 70ms. a time check -- if time amount is not over 70ms, it progresses to step S26 and quick return control is performed.

moreover, a time check -- if time amount is over 70ms, said 3rd timer will reset at step S27 -- having -- step S27 -- time of day t4 The clutch connection control set and mentioned later is started.

[0045] In addition, based on the period Ta which was explained about said drawing 13 and which cannot carry out dowel in, it decides on the deadline time amount of said 3rd timer in this operation gestalt. That is, the above-mentioned deadline time amount (70ms) is set up so that Period Ta may force the passing time amount at least and control may be performed. Although a convex side dowel and a concave side dowel will be contacted in the meantime, since duty ratio has decreased to 70%, the load which joins each dowel is small and becomes advantageous in reinforcement.

[0046] Moreover, you may make it set up in adjustable as a function of a gear, as it said that the deadline of the deadline time amount of the 3rd timer will be passed in 70ms if not only a fixed value but a gear is the range of 1 - the 3rd speed, and the deadline of it would be passed in 90ms if it is the range of 4 - the 5th speed.

[0047] On the other hand, it sets to said step S16 of drawing 16 , and is angle of rotation theta 0. If judged with it being the 1st less than reference value, the processing concerned will progress to step S30 of drawing 18 . a time check according to said 1st timer at step S30 -- since it is judged whether time amount exceeded 200ms and it is judged with having not exceeded in the beginning, after performing quick return control at step S31, it returns to step S16 of drawing 16 .

[0048] then, the time check of the 1st timer -- time amount exceeds 200ms, and if it is judged that this shift change ended in failure, the 1st timer will be reset in step S32. At step S33, the counted value of the re-entry counter mentioned later is referred to, and if it is in a reset condition (= 0), re-entry control which is judged [having not performed re-entry control and], progresses to step S34, and is mentioned later will be performed for the first time. This is because sense of incongruity may be made to hold in an operator if a shift change takes time amount.

[0049] On the other hand, if a re-entry counter is in a set condition (= 1), in spite of having performed re-entry control, in order to connect a clutch, without being judged with that in which a shift change did not succeed, and performing a shift change, it will progress to step S35. At step S35, a re-entry counter is reset and clutch connection control mentioned later is performed in step S36.

[0050] Subsequently, with reference to the flow chart of drawing 19 , the control approach of said re-entry control is explained. When the sleeve by which parallel translation is carried out is not able to move to shaft orientations to the fitting location of normal with a shift fork, re-entry control is processing which adds predetermined torque again and tries re-migration (inrush), after reducing migration torque temporarily.

[0051] At step S40, if it is among FET under PWM control, i.e., a shift up, and is among FET**, **, and a down shift, the duty ratio of FET** and ** will be reduced to 20%. Consequently, the driving torque added to a sleeve by the shift fork 11 becomes weaker.

[0052] step S41 -- the 4th timer -- a time check -- starting -- step S42 -- the time check of the 4th timer -- it is judged whether time amount exceeded 20ms. a time check -- if time amount is not over 20ms, it progresses to step S43 and quick return control is performed. moreover, a time check -- if time amount exceeds 20ms, the 4th timer will be reset at step S44, and said re-entry counter will be set at step S45. Then, since, as for the processing concerned, PWM control of return and the drive motor 1 is again carried out by 100% of duty ratio to said step S13 of drawing 16 , the big torque of the beginning will be added to a sleeve.

[0053] With this operation gestalt, since it was made to push with again strong torque if a shift change was not normally performed as described above after weakening the forcing torque of a sleeve temporarily, a sleeve can be reentered easily.

[0054] Here, before explaining actuation of said quick return control and clutch connection control to a detail, the meaning and the fundamental concept of each control are explained briefly.

[0055] The fundamental concept of clutch connection control is explained with reference to

introduction and drawing 32 . At this operation gestalt, it is time of day t1. When rotation of a shift spindle is started, connection of a clutch is canceled at time of day t11, and it is time of day t3. Rotation of a shift spindle is completed. then, time of day t4 up to -- after pushing and performing control, it shifts to clutch connection control of this invention.

[0056] In order to keep good a degree of comfort at the time of connecting a clutch, if it connects at a low speed and a clutch is put in another way, it is necessary to make rotational speed of the shift spindle 3 late. On the other hand, a gear change rate needs to make rotational speed of the shift spindle 3 quick, in order to be dependent on the rotational speed of the shift spindle 3 and to realize quick gear change.

[0057] so, in clutch connection control of this operation gestalt the two above-mentioned conditions -- coincidence -- being satisfied -- time of day t4 from -- t5 up to -- high-speed rotation of the shift spindle 3 is carried out until it results in a half-clutch condition -- making -- time of day t5 If it sets and a half-clutch condition begins time of day t6 which this half-clutch condition ends ****** -- low-speed rotation of the shift spindle 3 is carried out -- making -- further -- time of day t6 After setting and completing a half-clutch condition, it is compatible in a degree of comfort at the time of gear change, and compaction of gear change time amount by carrying out high-speed rotation of the shift spindle 3 again.

[0058] Subsequently, the judgment approach of the clutch connection start point (time-of-day t5 of drawing 32) in the above-mentioned clutch connection control is explained with reference to drawing 20 - drawing 23 .

[0059] This invention newly carries out the knowledge of the time amount rate of change of the rotational-speed difference the driving side of the clutch at the time of gear change and by the side of passive movement representing the connection condition of a clutch, and the description is in the point of having judged the connection start point of a clutch, i.e., the start point of a half-clutch, based on the time amount rate of change of said rotational-speed difference.

[0060] Drawing 20 is drawing which returns and carries out the shift up of the accelerator and in which having shown the absolute value A (Nd) of the driving side the clutch's in a typical gear change gestalt and the rotational speed Nin by the side of passive movement, Nout, and both rotational-speed difference Nd (= Nin-Nout).

[0061] If the shift up of the accelerator is returned and carried out, immediately after severing connection of a clutch, from from, the rotational speed Nin of a driving side (engine side) will fall, and a current rotational speed will be mostly maintained according to inertia by the passive-movement side (wheel side).

[0062] Then, if an automatic gear change process progresses, the connection start point of a clutch is reached and it will be in a half-clutch condition, it is dragged at a passive-movement side, and accelerates, and the rotational speed Nin of a driving side is the rotational speed Nout by the side of passive movement. Since a driving side serves as a rotation load, it slows down, and both rotational-speed difference A (Nd) is canceled at the point of a clutch ending [connection]. Therefore, both rotational-speed difference A (Nd) serves as a function which makes the connection start point of a clutch the strange pole (extremal value).

[0063] Drawing 21 is the driving side of the clutch at the time of carrying out a shift up, carrying out open actuation of the accelerator and the rotational speed Nin by the side of passive movement, Nout, and both rotational-speed difference Nd. It is drawing having shown the absolute value A (Nd).

[0064] If a shift up is carried out, carrying out open actuation of the accelerator, immediately after severing connection of a clutch, from from, the rotational speed Nin of a driving side will answer open actuation of an accelerator, it will go up, and a current rotational speed will be mostly maintained according to inertia by the passive-movement side.

[0065] Then, if an automatic gear change process progresses, the connection start point of a clutch is reached and it will be in a half-clutch condition, since a passive-movement side serves as a rotation load, it slows down, and the rotational speed Nin of a driving side is the rotational speed Nout by the side of passive movement. It is dragged by the driving side, and accelerates and both rotational-speed difference A (Nd) is canceled at the point of a clutch ending [connection]. Also in this case, both rotational-speed difference A (Nd) serves as a function

which makes the connection start point of a clutch the strange pole.
[0066] drawing 22 -- the crown -- the driving side of the clutch at the time of returning and carrying out the down shift of the accelerator from a rotation region and the rotational speed Nin by the side of passive movement, Nout, and both rotational-speed difference Nd It is drawing having shown the absolute value A (Nd).
[0067] the crown -- the rotational speed Nin of to [immediately after severing connection of a clutch, when the down shift of the accelerator was returned and carried out from the rotation region] a driving side -- falling -- rotational speed Nout by the side of passive movement It gradually decreases.
[0068] Then, if an automatic gear change process progresses, the connection start point of a clutch is reached and it will be in a half-clutch condition, it is dragged at a passive-movement side, and accelerates, and the rotational speed Nin of a driving side is the rotational speed Nout by the side of passive movement. Since a driving side serves as a rotation load, it slows down, and both rotational-speed difference A (Nd) is canceled at the point of a clutch ending [connection]. Also in this case, both rotational-speed difference A (Nd) serves as a function which makes the connection start point of a clutch the strange pole.
[0069] Drawing 23 is the driving side of the clutch at the time of carrying out a down-shift down, carrying out open actuation of the accelerator and the rotational speed Nin by the side of passive movement, Nout, and both rotational-speed difference Nd. It is drawing having shown the absolute value A (Nd).
[0070] If a down shift is carried out, carrying out open actuation of the accelerator, immediately after severing connection of a clutch, from from, the rotational speed Nin of a driving side will answer open actuation of an accelerator, it will go up, and a current rotational speed will be mostly maintained according to inertia by the passive-movement side.
[0071] Then, if an automatic gear change process progresses, the connection start point of a clutch is reached and it will be in a half-clutch condition, since a passive-movement side serves as a rotation load, a rise is barred, and the rotational speed Nin of a driving side is the rotational speed Nout by the side of passive movement. It is dragged by the driving side, and accelerates and both rotational-speed difference A (Nd) is canceled at the point of a clutch ending [connection]. Also in this case, both rotational-speed difference A (Nd) serves as a function which makes the connection start point of a clutch the strange pole.
[0072] Thus, at this operation gestalt, it is time amount rate-of-change deltaNd of the rotational-speed difference A the driving side of a clutch, and by the side of passive movement (Nd) irrespective of a gear change gestalt. The timing which shows the strange pole is made to carry out adjustable control of the gear change rate based on this paying attention to representing the node of a clutch, i.e., the start point of a half-clutch.
[0073] Subsequently, with reference to drawing 24 and 25, the fundamental concept of said quick return control is explained.
[0074] Although cascade control of the connection rate of a clutch is carried out with this operation gestalt as described above as described above, it may be desirable to connect a clutch immediately depending on the run state of a car or the contents of accelerator actuation.
[0075] Drawing 24 and 25 are the shift spindle location theta 0 by the quick return control performed at the time of a shift up and a down shift, respectively. And engine speed Ne It is drawing having shown signs that it changed.
[0076] Although it is common to open an accelerator after return an accelerator at the time of a shift up as shown in drawing 24 , carrying out ON actuation of the shift up switch 51, performing gear change actuation after that and re-connecting a clutch, it is the engine speed Ne in that case. It changes as the continuous line a showed.
[0077] However, it thinks, also when opening an accelerator before operating the shift up switch 51 or re-connecting a clutch, without returning an accelerator depending on a driver, and since the driver desires a prompt shift change, it is desirable [the driver] in such a case, to connect a clutch quickly.
[0078] So, at this operation gestalt, it is an engine speed Ne. When it changes like a continuous line b It judges with having operated the shift up switch 51, without a driver returning an

accelerator, and is an engine speed Ne. When it changes like a continuous line c It judges with the accelerator having been opened earlier than the timing to which a clutch is connected, and as continuous lines C and D showed, it was made to perform quick return control which connects a clutch immediately, respectively.
[0079] An accelerator is returned also at the time of a down shift, it carries out ON actuation of the down-shift switch 52, and as shown in drawing 25 on the other hand, after that, after gear change actuation is performed and a clutch is re-connected, it is common to open an accelerator, and the engine speed Ne in that case changes as the continuous line a showed it.
[0080] However, since it can acquire a good degree of comfort even if an engine carries out in a fore blow at the time of a down shift, may be carried out and connects a clutch quickly in such a case, it is desirable to make clutch connection quickly.
[0081] So, at this operation gestalt, it is an engine speed Ne. When it changed like continuous lines b and c, the engine was made for a driver to perform a fore blow or quick return control as judged that carried out by carrying out and shown as continuous lines C and D, respectively.
[0082] Subsequently, actuation of the above-mentioned quick return control and clutch connection control is explained to a detail.
[0083] Drawing 26 is the flow chart which showed the control approach of the quick return control performed at said steps S21, S26, S31, and S43.
[0084] This engine speed Ne at step S50 It is measured. Engine speed Ne measured at step S51 until now The peak hold value Nep and the bottom hold value Neb are said engine speed Ne. It is based and updated. At step S52, it is judged, if it is among a shift up, it will progress to step S56, and if it is among a down shift any in a shift up and a down shift they are, it will progress to step S53.
[0085] This engine speed Ne detected at said step S50 in step S56 Difference (Ne-Neb) with the bottom hold value Neb updated at said step S51 is 50rpm. It is judged whether it is above.
[0086] The judgment concerned is a judgment of whether the accelerator is closed at the time of a shift up, and said difference is 50rpm. If it is above, it will be judged with that by which the accelerator was opened earlier than the timing to which the shift up switch 51 was operated or a clutch is connected, without a driver returning an accelerator. In this case, it progresses to step S55 that a clutch should be connected immediately, and is the quick return flag Fquick. The processing concerned is ended after setting. Moreover, difference is 50rpm. It is the quick return flag Fquick that the usual control should be continued if it is the following. The engine revolving speed control concerned is ended without setting.
[0087] When judged with the inside of a down shift in said step S52, on the other hand, at step S53 Said engine speed Ne A difference (Ne-Ne1) with the engine speed Ne1 memorized at said step S12 is 300rpm. It is judged whether it is above and said difference is 300rpm. If it is above The peak hold value Nep furthermore updated at said step S51 in step S54, and this engine speed Ne A difference (Nep-Ne) is 50rpm. It is judged whether it is above.
[0088] the judgment of whether at the time of a shift up, the judgment concerned carried out the engine in the fore blow, and the driver carried out it -- it is -- said step S -- it judges with the driver having carried out racing to the judgment of 53 and 54 being affirmation [which] at the time of a shift up -- having -- step S55 -- progressing -- said quick return KUFURAGU Fquick The processing concerned is ended after setting.
[0089] Drawing 27 is the block diagram of the clutch connection control device which performs clutch connection control performed at said steps S28 (drawing 17) and S36 (drawing 18), and drawing 28 is the flow chart which showed the contents of control.
[0090] In drawing 27 , driving-side (clutch disc) 70a of a clutch is connected with Engine E, and passive-movement side (pressure plate) 70b of a clutch is connected with the driving wheel FW through the change gear. The clearance of passive-movement side 70b to driving-side 70a, i.e., **** of a clutch, is controlled by the clutch canceling release mechanical system 70 driven with an electric motor 1.
[0091] Driving-side rotational-speed detection section 71a detects the rotational speed Nin of said driving-side 70a. Passive-movement side rotational-speed detection section 71b is the rotational speed Nout of said passive-movement side 70b. It detects. The rotational-speed

difference detection section 72 is the detected driving-side rotational speed Nin and the passive-movement side rotational speed Nout. Difference Nd It detects. The rate-of-change detection section 73 is said detected rotational-speed difference Nd. Time amount rate-of-change deltaNd of an absolute value A (Nd) It detects.
[0092] A control section 74 is said detected time amount rate-of-change deltaNd. Said clutch is connected at the 1st rate until it becomes below a predetermined value, and it is time amount rate-of-change deltaNd. After becoming below a predetermined value It connects at the 2nd rate later than said 1st rate, and is Difference Nd. After becoming below other predetermined values, the electric motor 1 of said clutch canceling release mechanical system 70 is controlled to connect at the 3rd rate quicker than said 2nd rate.
[0093] Drawing 30 is drawing having shown the operating state of each part of drawing 27 , and is this drawing (a). The relation between the rotational speed of a clutch and time amount is shown, and it is this drawing (b). The relation between angle of rotation of a spindle and time amount is shown. Here, carrying out open actuation of the accelerator explained about said drawing 21 , actuation at the time of carrying out a shift up is made into an example, and it explains.
[0094] It is judged at step S70 of drawing 28 whether the vehicle speed is abbreviation 0. With this operation gestalt, if the vehicle speed is 3 or less km/h, it will judge with abbreviation 0, and it progresses to step S72, and is target include-angle thetaT of the shift spindle 3. It progresses to step S73, after setting a neutral location. A car is a shift in the condition of having carried out an abbreviation halt, and this is because gear change actuation does not influence at a degree of comfort in such a case but a quick shift change is desired.
[0095] Moreover, when the vehicle speed is judged in said step S70 to be 3 or more km/h, it is target include-angle thetaT about the 2nd criteria include angle (namely, **12 degrees) which returned from the include angle (this operation gestalt **18 degrees) to which rotation of the shift spindle 3 is restricted by the stopper only 6 times in step S71. It progresses to step S73, after setting. At step S73, it is the angle of rotation theta 0 of the current shift spindle 3 by the angle-type sensor 28. It is detected. Quick return control is performed at step S74.
[0096] At step S75, the PID aggregate value for proportional integral differential (PID) control is calculated. Namely, current angle of rotation theta 0 detected at said step S73 And target include-angle thetaT The differential (D) term which is the differential value of the proportionality (P) term expressed as difference (theta0 -thetaT), the integral (I) term which is the integral value of P term, and P term is searched for, respectively, and is added. At step S76, based on said calculated PID aggregate value, the duty ratio of PWM control is determined and PWM control is performed in step S77.
[0097] Drawing 31 is drawing having shown the relation of said PID aggregate value and duty ratio, if the polarity of a PID aggregate value is forward, forward duty ratio will be chosen according to the value, and if the polarity of a PID aggregate value is negative, negative duty ratio will be chosen according to the value. Here, the combination of FET by which PWM control is carried out is shown, for example, as for the polarity of duty ratio, 50% of duty ratio means that PWM control of FET** and the FET** is carried out by 50% of duty ratio, and -50% and duty ratio mean that PWM control of FET** and the FET** is carried out by 50% of duty ratio.
[0098] step S78 -- the time check of the 6th timer -- it is judged whether time amount exceeded 100ms, and since the 6th timer has not started the time check at first, it progresses to step S82. At steps S82, S83, and S84, "judgment of clutch connection start point" processing, "judgment of point ending [clutch connection]" processing, and "renewal of target opening" processing are performed, respectively.
[0099] Drawing 29 is the above-mentioned flow chart which showed actuation of each three processings to the detail. The rotational speed Nin of driving-side 70a of the clutch detected by said driving-side rotational-speed detection section 71a at step S821 when it progressed to "judgment of clutch connection start point" processing of step S82, and rotational speed Nout of passive-movement side 70b detected by said passive-movement side rotational-speed detection section 71b Difference Nd It is detected by said rotational-speed difference detection section 72.

[0100] At step S822, it is said detected rotational-speed difference Nd. If an absolute value A (Nd) is compared with a reference value Nref1 and the rotational-speed difference A (Nd) is less than the reference value Nref1, in step S823, it will be judged whether this gear change is a shift up. If judged with a shift up, at step S824, they are throttle opening thetath and criteria opening thetaref. It is compared and throttle opening thetath is criteria opening thetaref. If it has exceeded, it will set to step S825 further, and they are the current vehicle speed V and the criteria vehicle speed Vref. It is compared.
[0101] It is carried out in order to judge whether the start clutch of a centrifugal type is in a connection condition, and detection of the vehicle speed V concerned is said reference value Vref. It is the variable which makes a current gear stage a function. Here, the vehicle speed V is the criteria vehicle speed Vref. If judged with it having exceeded and a start clutch being in a connection condition, it will progress to step S826 that it should judge whether it is the connection start point of a gear change clutch.
[0102] At step S826, it is time amount rate-of-change deltaNd of said detected rotational-speed difference A (Nd) by said rate-of-change detection section 73. It is detected. Furthermore, a control section 74 is said detected time amount rate-of-change deltaNd. It compares with the predetermined reference value Nref2. Said reference value Nref2 is current time amount rate-of-change deltaNd. It is beforehand set as the value which can be judged that the strange pole is shown. Immediately after initiation of gear change actuation, as said drawing 20 -24 were explained, it is time amount rate-of-change deltaNd. Since it has exceeded the reference value Nref1, it progresses to "judgment of point ending [clutch connection]" processing of step S83 as it is.
[0103] At step S83, it progresses to "renewal of target opening" processing of step S84 in step S831, without performing judgment processing of the point ending [clutch connection] substantially, since it is judged based on the half-clutch beginning flag Fst whether it is a half-clutch condition and it is judged with it not being in a half-clutch condition here.
[0104] thus -- this operation gestalt -- the connection condition of a clutch -- said rotational-speed difference Nd being based -- coming out -- there is nothing -- rotational-speed difference Nd Since it was made to judge based on an absolute value A (Nd) The rotational speed of driving-side 70a or passive-movement side 70b is sharply changed according to a certain external cause etc., and it is the rotational-speed difference Nd. Even if less than a reference value, unless an absolute value A (Nd) is less than a reference value, it is not judged with the rotational frequency difference of driving-side 70a and passive-movement side 70b having been canceled.
[0105] Moreover, since the judgment based on the time amount rate of change of said rotational-speed difference A (Nd) is performed with this operation gestalt only when gear change actuation is a shift up and throttle opening is beyond a predetermined value For example, even if a throttle is closed while the vehicle speed had maintained constant value from habit, the rotational speed of driving-side 10a falls and the conditions of said step S826 may be satisfied accidentally, the misjudgment law of this is not carried out to the connection start point of a clutch.
[0106] Furthermore, with this operation gestalt, since it does not shift to judgment processing of step S826 unless the vehicle speed has exceeded the reference value which becomes settled by the gear stage, in the state of the stop to which the start clutch of a centrifugal type is not connected, it is not judged with a half-clutch condition, and, moreover, the judgment can be made correctly.
[0107] At step S841 of the return and "renewal of target opening" processing to drawing 29 , since it is judged based on the half-clutch beginning flag Fst whether it is a half-clutch condition, the half-clutch beginning flag Fst is not yet set here and a half-clutch condition is not reached, in step S842, it is set up as target opening with the new include angle subtracted from the present target opening only 1 degree. At step S85, it is judged whether a target include angle is close to a neutral include angle, and processing of said steps S73-S85 is repeated until a target include angle fully approaches a neutral include angle.
[0108] Since 1 degree of target opening has also decreased with this operation gestalt at this

time, at steps S75-S76, a PID value is set as a comparatively big value. Therefore, at step S77, as shown in drawing 30 , a spindle is comparatively high-speed, it rotates, and passive-movement side 70b approaches driving-side 70a at high speed according to said clutch canceling release mechanical system 70.

[0109] Then, time of day t6 of drawing 30 It sets and is time amount rate-of-change deltaNd. If it is less than a reference value Nref2 and this is detected in step S826 of drawing 29 , a control section 74 will judge it as the thing which reaches the connection start point of a clutch and by which the half-clutch condition was started, and will set the half-clutch beginning flag Fst in step S827.

[0110] In "judgment of point ending [clutch connection]" processing of continuing step S83, in step S831, since it is judged based on the half-clutch beginning flag Fst whether it is a half-clutch condition and it is judged with a half-clutch condition here, it progresses to step S832. The rotational-speed difference A (Nd) is compared with a reference value Nref3 by step S832. It is beforehand set as the value which can be judged that connection of a clutch ended said reference value Nref3.

[0111] At first, since the rotational-speed difference A (Nd) has exceeded the reference value Nref3, the processing concerned progresses to "renewal of target include angle" processing of step S84, at the step S841, shortly, is judged to be a half-clutch condition and progresses to step S843. At step S843, it is half-clutch ending flag Fend. It is judged, and since it is still in a half-clutch condition whether it was based and the half-clutch was completed here, it progresses to step S844.

[0112] At step S844, it is said quick return flag Fquick. It is referred to and is the quick return flag Fquick. If not set, in step S845, it is set up as target opening with the new include angle subtracted from current target opening only 0.1 degrees. Therefore, since a spindle rotates with a low speed comparatively as the PID value was set as the comparatively small value at the following steps S75-S76 and step S77 showed to drawing 30 , passive-movement side 70b approaches driving-side 70a gently with a low speed according to said clutch canceling release mechanical system 70.

[0113] In addition, it sets to said step S844, and is the quick return flag Fquick. If judged with being set, at step S846, it will be registered as a target include angle with the include angle new [that quick return control should be performed] subtracted from the current target include angle only 2 thru/or 4 degrees. Therefore, at the following steps S75-S76, since a PID value is set as a big value and a spindle rotates at high speed at step S77, passive-movement side 70b approaches driving-side 70a at high speed according to said clutch canceling release mechanical system 70.

[0114] Then, time of day t6 of drawing 30 It sets and is the rotational-speed difference Nd. If it is less than a reference value Nref2 and this is detected in step S832 of drawing 29 , it judges that the point of a clutch ending [connection] was reached, it sets to step S833, and a control section 74 is half-clutch ending flag Fend. It sets.

[0115] Thus, with this operation gestalt, beforehand, since decision of the (step S831 detects the point of the clutch in affirmation) and said step S83 ending [connection] on condition that the connection start point of a clutch was detected in step S82 Even if it changes sharply the rotational speed of driving-side 70a or passive-movement side 70b according to a certain external cause etc. and the conditions of said step S833 are satisfied before detection of the connection start point of the clutch in step S82, the misjudgment law of this is not carried out to the point of a clutch ending [connection].

[0116] In "renewal of target opening" processing of continuing step S84, it progresses to step S847 through steps S841 and S843, and a neutral include angle is set up as a target include angle. Therefore, at the following steps S75-S76, since a spindle rotates at high speed as the PID value was set as the big value and step S77 showed to drawing 30 , passive-movement side 70b approaches driving-side 70a at high speed according to said clutch canceling release mechanical system 70.

[0117] Then, if a target include angle fully approaches a neutral include angle, at step S86 of drawing 28 , a neutral include angle will be registered as a target include angle, and the 6th timer

wiil start a time check at step S87.
[0118] on the other hand -- said step S78 -- setting -- the time check of the 6th timer -- if judged with time amount having exceeded 100ms, the 6th timer will be reset at step S90. At steps S91, S92, and S93, they are quick return KUFURAGU Fquick, the half-clutch beginning flag Fst, and half-clutch ending flag Fend, respectively. It is reset and PWM control of a switching circuit 105 is ended at step S94.
[0119] In addition, if a gear is shifted from a neutral condition at the time of high-speed transit or high engine rotation, comparatively big engine brake will act and an excessive load will join an engine. So, with this operation gestalt, even if ON actuation of the shift up switch 51 is carried out to the vehicle speed being [10 or more km/h or an engine speed] 3000 or more rpm, the forbiddance-of-gear-change system which prevents control of said drawing 16 is formed.
[0120] Drawing 11 is the functional block diagram of said forbiddance-of-gear-change system. If the neutral detection section 81 has a gear in a neutral location, it will output the signal of "H" level. The vehicle speed judging section 82 outputs the signal of "H" level as the vehicle speed is 10 or more km/h. The engine-speed judging section 83 outputs the signal of "H" level as an engine speed is 3000 or more rpm.
[0121] OR circuit 84 outputs the signal of "H" level as the output of the vehicle speed judging section 82 or the engine-speed judging section 83 is "H" level, and AND circuit 85 outputs the signal of "H" level as the output of OR circuit 84 and the output of the neutral detection section 81 are "H" level. The forbiddance-of-gear-change section 86 prevents control of said drawing 16 , even if ON actuation of the shift up switch 51 is carried out to the output of AND circuit 85 being "H" level.
[0122] However, since re-acceleration takes time amount when it is under acceleration from the 1st speed and the vehicle speed has shifted to a neutral accidentally [engine speed / 10 or more km/h or / rpm / 3000 or more], as long as it adds the above-mentioned forbiddance-of-gear-change system, when it is [vehicle speed] under transit (the vehicle speed is 3 or more km/h), the system which forbids a shift in a neutral may be added further.
[0123]
[Effect of the Invention] According to this invention, since connection actuation is performed with a low speed, the connection start point (start point of a half-clutch) of a clutch which influences the right and wrong of a degree of comfort to the point (ending point of a half-clutch) ending [connection] can maintain a good degree of comfort, and connection actuation is further performed at high speed to termination of automatic gear change actuation from the point of a clutch of not influencing the right and wrong of a degree of comfort ending [connection]. Therefore, the time amount which automatic gear change takes can be shortened, a degree of comfort does not become coarse at the time of connection of a clutch, either, and good operability is acquired.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view of the control unit of a car in which the electromotive change gear of this invention is carried.
[Drawing 2] It is the fragmentary sectional view having shown the configuration of the principal part of the drive system of the electromotive change gear which is 1 operation gestalt of this invention.
[Drawing 3] It is a conceptual diagram in the condition that the sleeve and the gear were engaged.
[Drawing 4] It is the perspective view of the sleeve of this invention.
[Drawing 5] It is the perspective view of the gear of this invention.
[Drawing 6] It is the partial enlarged drawing of the convex side dowel 32 of a sleeve.
[Drawing 7] It is the partial enlarged drawing of the concave side dowel 42 of a gear.
[Drawing 8] It is drawing having shown the engagement condition of the convex side dowel 32 and the concave side dowel 42.
[Drawing 9] It is the perspective view of the conventional sleeve.
[Drawing 10] It is the perspective view of the conventional gear.
[Drawing 11] It is the functional block diagram of a forbiddance-of-gear-change system.
[Drawing 12] It is drawing having shown the engagement timing of the conventional sleeve and a gear typically.
[Drawing 13] It is drawing having shown the engagement timing of the sleeve of this invention, and a gear typically.
[Drawing 14] It is the block diagram having shown the configuration of the principal part of the control system of the electromotive change gear which is 1 operation gestalt of this invention, and is **.
[Drawing 15] It is the block diagram having shown the example of a configuration of ECU100 shown in drawing 14 .
[Drawing 16] It is the flow chart (the 1) of 1 operation gestalt of this invention.
[Drawing 17] It is the flow chart (the 2) of 1 operation gestalt of this invention.
[Drawing 18] It is the flow chart (the 3) of 1 operation gestalt of this invention.
[Drawing 19] It is the flow chart (the 4) of 1 operation gestalt of this invention.
[Drawing 20] The driving side of the clutch at the time of returning and carrying out the shift up of the accelerator and the rotational speed Nin by the side of passive movement, and Nout And rotational-speed difference Nd It is shown drawing.
[Drawing 21] The driving side of the clutch at the time of carrying out a shift up, carrying out open actuation of the accelerator and the rotational speed Nin by the side of passive movement, and Nout And rotational-speed difference Nd It is shown drawing.
[Drawing 22] the crown -- the driving side of the clutch at the time of returning and carrying out the down shift of the accelerator from a rotation region and the rotational speed Nin by the side of passive movement, and Nout And rotational-speed difference Nd It is shown drawing.
[Drawing 23] The driving side of the clutch at the time of carrying out a down-shift down, carrying out open actuation of the accelerator and the rotational speed Nin by the side of

passive movement, and Nout And rotational-speed difference Nd It is shown drawing.
[Drawing 24] It is timing CHIETO (at the time of a shift up) of the shift spindle and engine speed which this invention depends of operation.
[Drawing 25] It is timing CHIETO (at the time of a down shift) of the shift spindle and engine speed which this invention depends of operation.
[Drawing 26] It is the flow chart of quick return control.
[Drawing 27] It is the block diagram of the clutch connection control device which is 1 operation gestalt of this invention.
[Drawing 28] It is the flow chart of clutch connection control.
[Drawing 29] It is the flow chart which showed main actuation of clutch connection control to the detail.
[Drawing 30] It is drawing having shown the operating state of each part of drawing 27 .
[Drawing 31] It is drawing having shown the relation between a PID aggregate value and duty ratio.
[Drawing 32] It is timing CHIETO of the shift spindle by this invention of operation.
[Drawing 33] It is drawing having shown actuation of the conventional technique.
[Description of Notations]
1 [-- A gear change clutch, 10 / -- A shift drum, 11 / -- A shift fork, 28 / -- An angle-type sensor, 30 / -- A sleeve, 40 / -- A gear, 51 / -- A shift up switch, 52 / -- Down-shift switch,] -- A drive motor, 2 -- A moderation gear device, 3 -- A shift spindle, 5 70 [-- The driving-side rotational-speed detection section 71b / -- The passive-movement side rotational-speed detection section, 72 / -- The rotational-speed difference detection section, 73 / -- The rate-of-change detection section, 74 / -- Control section] -- A clutch canceling release mechanical system, 70a -- The driving side of a clutch, 70b -- The passive-movement side of a clutch, 71a

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[Translation done.]